

DETAILED ACTION

Information Disclosure Statement

1. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609.04(a) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

Claim Objections

1. Claim 30 objected to because of the following informalities: Claim 30 does not exist. Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 36 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 36 depends from claim 45, which does not exist. It is therefore unknown what limitations are imported into claim 36 by its dependence.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 4, 6-10, 15, 18, 20 and 25 rejected under 35 U.S.C. 102(b) as being anticipated by Albrecht, et al (U.S. Patent Application Publication 2002/0101902 A1).

Regarding claims 1 and 15, Albrecht discloses a method of producing vacuum ultraviolet (VUV) light, comprising the steps of:

maintaining a gas mixture containing a rare gas and a halogen in a chamber so that at least a portion of said gas mixture is disposed in an emission region between a pair of electrodes at a selected pressure (Fig. 13a; Fig 14a; paragraphs 0064 and 0085);

applying electrical potential between said electrodes so as to form an electrical discharge in said emission region between said electrodes and apply power to the gases in said emission region at a selected power density to thereby form excimers selected from the group consisting of RGZ* and Z2* where RG represents a rare gas and Z represents a halogen (Fig. 14a; paragraph 0022, paragraph 0005);

maintaining a concentration of said halogen in the chamber substantially equal to an optimum concentration which maximizes ultraviolet emission from said excimers at said selected pressure and power density (paragraph 0007, paragraph 0012, paragraph

0030, paragraph 0097),

and the apparatus for performing these steps.

Regarding claims 4 and 18, Albrecht discloses wherein said selected pressure is at least about 0.3 bar (paragraph 0090).

Regarding claims 6 and 7, Albrecht discloses wherein said gas mixture includes F₂ and said excimers are of the form F₂^{*} (paragraphs 0005, 0007; an F₂ laser is known to refer to a laser in which the gas includes F₂ and the excimers are of the form F₂^{*}).

Regarding claims 8 and 9, Albrecht discloses wherein said gas mixture includes argon and fluorine, and said excimers are ArF^{*} (paragraphs 0005, 0007).

Regarding claims 10 and 20, Albrecht discloses wherein said concentration of said halogen in said chamber is 1% (Fig. 3).

Regarding claim 25, Albrecht discloses wherein at least a portion of said chamber is transparent to ultraviolet light emissions (inherent to the ability for output beam 13 in Fig. 13a to exit as depicted; if at least part of chamber 1 is not transparent to ultraviolet light emissions, the light could not enter optics portion 3 and exit as an output beam 13).

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 2, 3, 16 and 17 rejected under 35 U.S.C. 103(a) as being unpatentable over Albrecht in view of El-Habachi, et al ("Emission of excimer radiation from direct current, high-pressure hollow cathode discharges" Appl. Phys. Lett., Vol. 72., No. 1, pp. 22-24, 5 January 1998).

Albrecht discloses the method of claim 1 and the apparatus of claim 15, but fails to teach passing said gas mixture through said chamber at a selected flow rate, wherein said gas mixture passed through said chamber contains an amount of halogen selected substantially equal to an optimum amount which maximizes said ultraviolet emissions at said selected flow rate, pressure and power density; however, El-Habachi teaches that an excimer lamp preferably operates under a flow of said gas. In particular, El-Habachi states "the argon discharge was operated in flowing gas, at 380 sccm. Operating the discharge without flow caused a reduction of the intensity by more than an order of magnitude. A possible reason for this decay is the increased contamination of the gas by electrode vapor."

Thus, El-Habachi teaches an explicit reason for operating an excimer lamp such as that taught by Albrecht under a selected flow rate. Albrecht's apparatus is already equipped to perform such an operation (see Figs. 13a, 13b, and 14a). It would therefore have been obvious by explicit motivation taught by El-Habachi for one of ordinary skill in the art to, in Albrecht's apparatus, pass said gas mixture through said chamber at a selected flow rate (in particular, 380 sccm, which is greater than 30 sccm as required by claims 3 and 17), wherein said gas mixture passed through said chamber contains an amount of said halogen selected substantially equal to the

optimum amount which maximizes said ultraviolet emissions at said selected flow rate, pressure and power density.

4. Claims 13 and 23 rejected under 35 U.S.C. 103(a) as being unpatentable over Albrecht in view of Salvermoser, et al (U.S. Patent 6,400,089). Albrecht teaches the method of claim 1 and the apparatus of claim 15, but fails to teach wherein said electrodes are needle shaped such that they taper to a point; however, Salvermoser teaches an excimer lamp system in which the emission electrodes taper to a point (Fig. 16). Since Salvermoser's tapered electrodes were a known option for use in an excimer lamp such as that taught by Albrecht, it would have been obvious to substitute these tapered electrodes for the electrodes in Albrecht's lamp because the substitution would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

5. Claims 14 and 24 rejected under 35 U.S.C. 103(a) as being unpatentable over Albrecht in view of Meller, et al (U.S. Patent 5,729,565). Albrecht teaches the method of claim 1 and the apparatus of claim 15, but fails to teach wherein said electrodes have a rounded shape such that the ends are convexly shaped and are substantially rounded; however, Meller teaches an excimer lamp system in which the emission electrodes electrodes have a rounded shape such that the ends are convexly shaped and are substantially rounded (14 and 16). Since Meller's rounded electrodes were a known option for use in an excimer lamp such as that taught by Albrecht, it would have been obvious to substitute these rounded electrodes for the electrodes in Albrecht's

lamp because the substitution would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

Allowable Subject Matter

6. Claims 26-29, 31-35, and 37-43 allowed.

7. The following is an examiner's statement of reasons for allowance: The prior art fails to teach maintaining the plasma at a temperature such that the average kinetic energy of gas particles in said discharge region is such that there is only a negligibly small equilibrium population of vibrationally highly excited RG2* molecules with vibration energy levels close to the binding energy of the RG2* excimer, as required by independent claims 26 and 37.

8. Claims 5, 11, 12, 19, 21, and 22 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. The following is a statement of reasons for the indication of allowable subject matter:

Regarding claims 5 and 19, Switkes, et al ("Imaging of 1-nm-thick films with 193-nm microscopy" Optics Letters, Vol. 26, No. 15, August 1, 2001) may be considered representative of the state of the art at the time of the invention, as it was described to be on page 3 of the applicant's specification. Switkes teaches an ArF* discharge that radiates "as much as 30 mW of 193-nm light" from a discharge space of 300 micrometers radius (p.1183). This calculates to a power density about two orders of magnitude lower than the claimed power density. This is considered by Switkes to be

a "prototype bright cw 193-nm source" (p. 1183), and so a source that is two orders of magnitude brighter was clearly not envisioned at that time.

Regarding claims 11 and 21, while Albrecht discloses the use of a concentration between 1 and 5% (specifically 1%), a concentration range as narrow as 2% is not disclosed.

Regarding claims 12 and 22, Albrecht discloses the application of a frequency of 2 kHz, nearly two orders of magnitude lower than the claimed frequency of 100 kHz. Switkes discloses a frequency of 7 kHz, again nearly two orders of magnitude lower than what is claimed. Clearly the state of the art prior to the invention envisioned the use of frequencies much lower than what is claimed.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL MASKELL whose telephone number is (571)270-3210. The examiner can normally be reached on Monday-Friday 8AM-5PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Kim can be reached on 571/272-2293. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Michael Maskell/
Examiner, Art Unit 2881
11 June 2008

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Supervisory Patent Examiner, Art Unit 2881